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HOLDING WRENCH FOR ROCK DRILLING MACHINE AND ROCK DRILLING MACHINE INCLUDING SUCH A HOLDING WRENCH

Field of the invention

5 The invention concerns a holding wrench according to the preamble of claim 1 and a rock drilling machine including such a holding wrench.

Background of the invention

10 In the process of rock drilling, a drill string having a reamer at its free end has to be assembled in accordance with the advancement of the reamer into the rock structure. Thus drill string components are accordingly joined so as to form the drill string at a proximal end thereof, generally by screwing a new drill string component onto the advanced drill string. After further advancement of the reamer, a new drill
15 string component is added similarly to the proximal end of the thus advanced drill string and so on.

20 Disassembling of the drill string is carried out in the opposite way, i.e. the drill string is drawn into the drilling machine under successive loosening of the proximal drill string component from the rest of the drill string.

25 In order to control the drill string and to allow the most proximal drill string component to be joined and disjoined respectively, the drill string has to be fixed against rotational movement, which is accomplished by engagement of a holding wrench. There are different types of holding wrenches used for this purpose, for example fixed wrenches having gripping jaws positioned inside a U-shaped gripping head. It is also known to have gripping means being pivotally supported so as to be positioned into gripping position by means of
30 actuators. In case of large dimensions there are corresponding

high demands for powerful actuators so as to resist forces occurring during in particular in loosening of a drill string component during disassembling of the drill string.

Aim and most important features of the invention

5 It is an aim of the invention to provide an improved holding wrench of the kind indicated above which is capable of resisting important forces emanating during assembling and disassembling of a drill string and still be possible to be manufactured with relatively small dimensions.

10 This aim is obtained in accordance with a holding wrench with the features of claim 1.

Hereby it is ensured that the gripping means are not relocated during wrenching movement, since the closed rigid wrench structure guarantees that the gripping means remain into
15 gripping contact with the wrenching surfaces of the drill string component also if they are subjected to important forces.

The invention also makes it possible to reduce the dimensions on the gripping means as well as the positioning means. In
20 particular the latter only have to be dimensioned for moving the gripping means and not for resisting any wrenching forces.

A holding wrench according to the invention is particularly useful for excavating drilling machines meaning that a relatively large diameter drill bit, or a reamer, is used and
25 in particular where the frame opening is dimensioned such that the reamer can pass said frame opening under retraction of the entire drill string including the reamer. In this case there is a demand for the gripping means to be able to move between the active position where it is capable of gripping a drill

string having a diameter of perhaps only about $1/5 - 1/3$ of the free diameter of the frame opening.

It is preferred that the locking means are pivotally movable and in particular that they form hook parts that upon pivoting engagement pins or the like on an adjacent gripping means. It is preferred that the engagement means are actuated by linear hydraulic actuators but pneumatic and electric actuators can also be useful.

In an embodiment the locking means are rotatable and engage into a corresponding element by means of for example screw threads or bayonet coupling elements by means of a rotational actuator.

Further advantages of the invention result from other features and will be indicated in the following detailed description of an embodiment.

Brief description of drawings

The invention will now be described in more detail at the background of an embodiment and with reference to the drawings, wherein:

Fig. 1 shows a drilling machine making use of a holding wrench according to the invention,

Fig. 2 shows the drilling machine of Fig. 1 in a first perspective view,

Fig. 3 shows the drilling machine according to Fig. 1 in a second perspective view,

Fig. 4 shows a holding wrench according to the invention in an inactive position,

Fig. 5 shows the holding wrench of Fig. 4 in an active position gripping a drill string component,

Fig. 6 shows parts of the holding wrench of Fig. 4 and 5 in an enlarged perspective view, and

Fig. 7 shows the holding wrench according to Figs. 4-6 together with a guide bushing for a pilot bit.

Description of an embodiment

In Fig. 1 there is shown a rock drilling machine for excavating purposes, wherein a reamer 3, which is carried on a drill string 2, excavates a cylindrical part of rock formation. A pilot bit is indicated with 4 and a head frame of a holding wrench according to the invention is indicated with 5. The rock drilling machine 1 provides several additional details which are not part of this invention and therefore not described here.

In the perspective view in Fig. 2 the rock drilling machine 1 is shown having at its left end a compartment for storing drill string components 2' to be assembled into a drill string. A derrick 8 includes the head frame 5 of the holding wrench 6, wherein the free opening of the frame 5 viz. the frame opening 7 appears as having a diameter substantially exceeding the diameter of the drill string component 2'. The derrick is tiltable by power means which are not part of this invention and therefore not described here.

In the second perspective view of the rock drilling machine 1 in Fig. 3 the frame opening 7 is shown in connection with the comparatively large diameter reamer 3, which is intended to be drawn inside the rock drilling machine, that is through the frame opening 7, after the finishing of one bore hole and during transport to the next drilling position.

In Fig. 4 a holding wrench having only a slightly differently shaped head frame 5 from the one shown in Fig. 2 and 3 is shown. Fig. 4 shows the holding wrench in the inactive position of the gripping means 9, wherein free passage through the frame opening 7 is allowed since the gripping means are entirely positioned beside said opening 7. In Fig. 4 there is further shown two locking means 14, one positioned on each gripping means 9 and have the function which will be described in more detail below.

In Fig. 5 the gripping means 9 have been displaced to their active position such that they engage with wrenching surfaces (20 in Figs. 1 and 2) on a drill string component. In this position the gripping means are interlocked to each other by the locking means on one gripping means engaging an engagement means on an adjacent gripping means so as to form a closed rigid wrench structure which entirely encloses a drill string component 2'.

In Fig. 6 parts of the holding wrench are shown without the background of the head frame for clarity reasons. In Fig. 6 the gripping means are, like in Fig. 5, in the active position, that is with the gripping means being rigidly interconnected to each other by means of the locking means. These are in the form of pivotal engagement elements which are at least partly hook shaped, and wherein each respective hook portion catches an engagement means 15 in the form of a pin which is positioned at an adjacent area of an adjacent gripping means.

In Fig. 6 there is further shown a respective pivot axes 12, around which the gripping means are pivotally movable by means of one respective positioning means 10 which in this case is a hydraulic cylinder. In more detail each gripping means

provides a swing arm 11 for obtaining the sufficient distance when rotating between the active position and the inactive position. Each locking means is movable by means of one respective linear actuator 17, also in the form of a hydraulic cylinder.

Inside each gripping means there are a number, here 2, gripping surfaces 13 which in this case are positioned at right angle to each other, for engagement with the similarly shaped wrenching surfaces on the respective drill string components 2'.

The invention also provides for the possibility of having the holding wrench acting as a guide for a starter sub (detail 4' in Fig. 1) which carries the pilot bit 4, at the initial stage of a drilling operation. This is accomplished by having the holding wrench in its active, closed position, holding a guide bushing 18 having an inside opening allowing axial movement of the starter sub (4' in Fig. 1). This is done during only a short distance allowing the pilot bit to be fully established in its pilot hole in the rock. Thereafter the holding wrench is opened and the guide bushing, which preferably consists of two halves, is removed, whereafter the drilling procedure continues.

The invention may be modified within the scope of the invention. For example the gripping means may be actuated differently by for example pneumatic or electric actuators. The number of gripping means may be different, for example three or four. The position of the locking means may be altered and it is also within the scope of the invention to provide locking by other means than by pivotal hooking together two adjacent gripping means. An example of this is to have screw means and another example is bayonet coupling means

between two adjacent gripping means. It should be understood that it is preferred that the movement of the gripping means as well as the movement of the locking means are controlled either automatically by a control system or distance
5 controlled by an operator.

It is however not excluded that locking is made entirely manually although this is not preferred with respect to this invention.

The invention has been described mainly at the background of a
10 particular rock drilling machine with excavating reamer but it is to be understood that the invention is applicable also in other types of rock drilling applications.

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Claims:

1. Holding wrench (6) for holding drill string components (2) for the purpose of assembling or disassembling a drill string (2) during a drilling process and including positioning means (10) for moving at least two gripping means (9) into engagement with wrenching surfaces (20) of the drill string components, wherein the gripping means are pivotally supported on a head frame (5) so as to be pivotal in a plane perpendicular to a central axis of the drill string between an active, gripping position and an inactive, retracted position, and wherein the head frame (5) has a frame opening (7) for the passage of the drill string (2), **characterized in that** each gripping means (9) includes locking means (14) for interlocking engagement with engagement means (15) on an adjacent gripping means (9) in the active position so as to obtain a closed rigid wrench structure.
2. Wrench according to claim 1, **characterized in that** the frame opening (7) allows the passage of a reamer (3) for excavating rock in the inactive position of the gripping means.
3. Wrench according to claim 1 or 2, **characterized in that** each locking means (14) includes a pivotal engagement element.
4. Wrench according to claim 3, **characterized in that** each pivotal engagement element (14) is at least partly hook-shaped.
5. Wrench according to any of the previous claims, **characterized in that** each engagement means (15) is pin-shaped.
6. Wrench according to any of the claims 3 - 5, **characterized in that** the engagement element (14) is actuated by a linear

actuator (17) of the group: hydraulic motor, pneumatic motor, electric motor.

5 7. Wrench according to claim 1 or 2, **characterized in that** each locking means is rotatable and that interlocking engagement with the engagement means is obtained through a rotational movement.

8. Wrench according to claim 7, **characterized in that** interlocking engagement is obtained through any of the group: screw treads, bayonet coupling elements.

10 9. Wrench according to claim 7 or 8, **characterized in that** the locking means is actuated by a rotational actuator from the group: hydraulic motor, pneumatic motor, electric motor.

15 10. Wrench according to any of the previous claims, **characterized in that** each gripping means (9) is pivotal in a plane which is parallel to the general plane of the head frame.

20 11. Wrench according to any of the previous claims, **characterized in that** each positioning means (9) is an actuator from the group: hydraulic linear or rotatable motor, electric linear or rotatable motor, pneumatic linear or rotatable motor.

12. Wrench according to any of the previous claims, **characterized in that** the number of gripping means (9) is two - four.

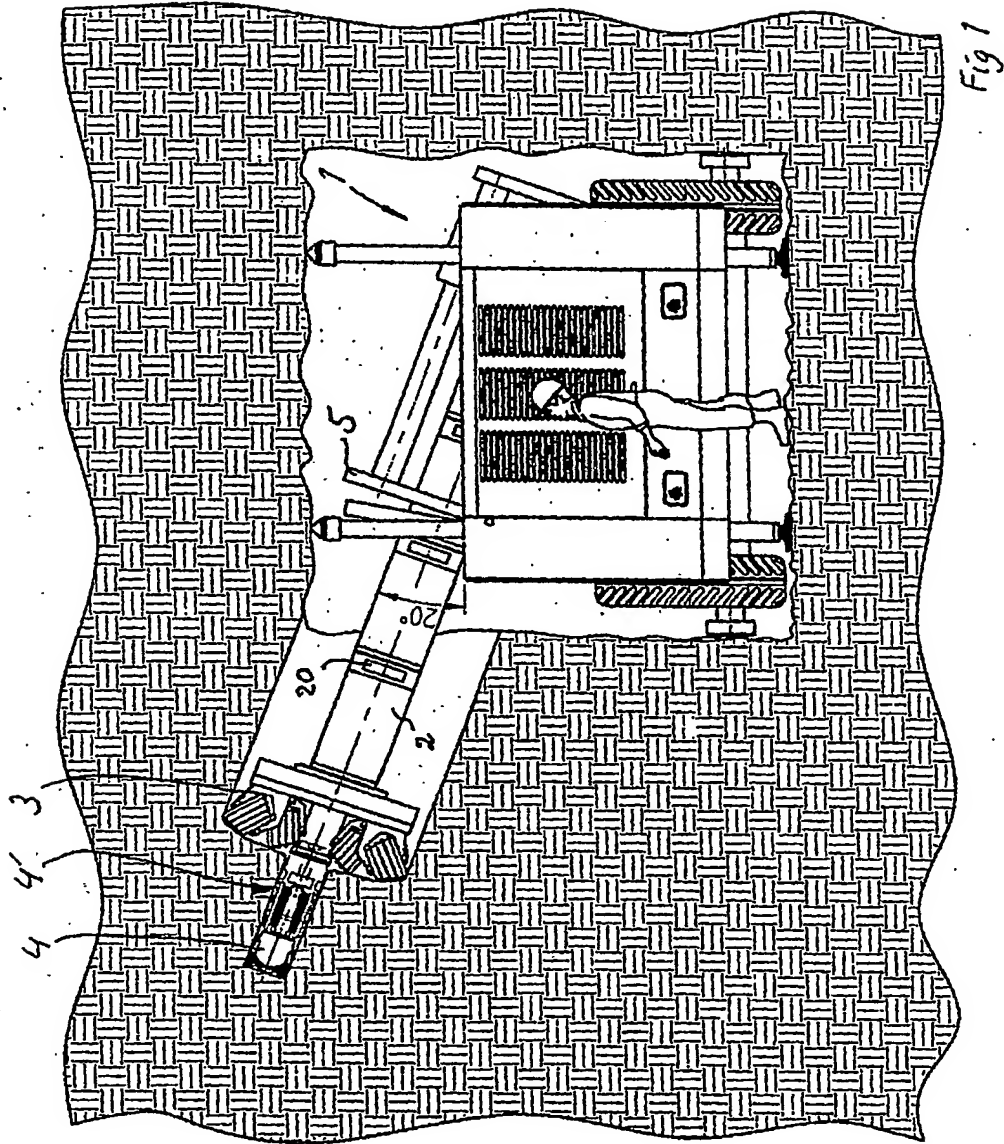
25 13. Drilling machine (1) for extracting ore from an ore-bearing rock through excavation with a reamer (3) having its cutting surface directed from the machine during the process of drilling, and including a wrench (6) according to any of the claims 1 - 12 for holding drill string components for the

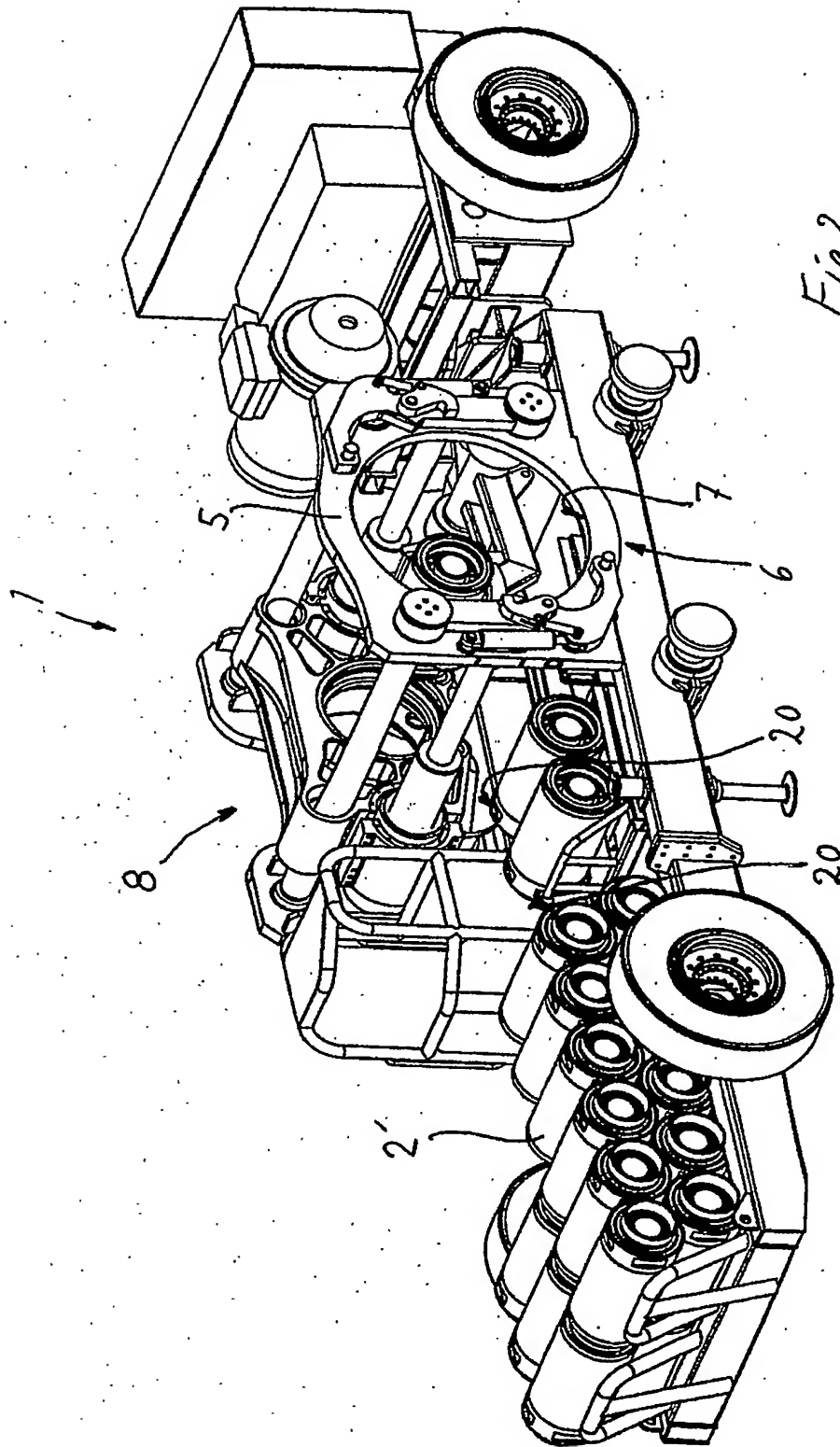
purpose of assembling or disassembling a drill string (2), carrying the reamer (3), during the drilling process.

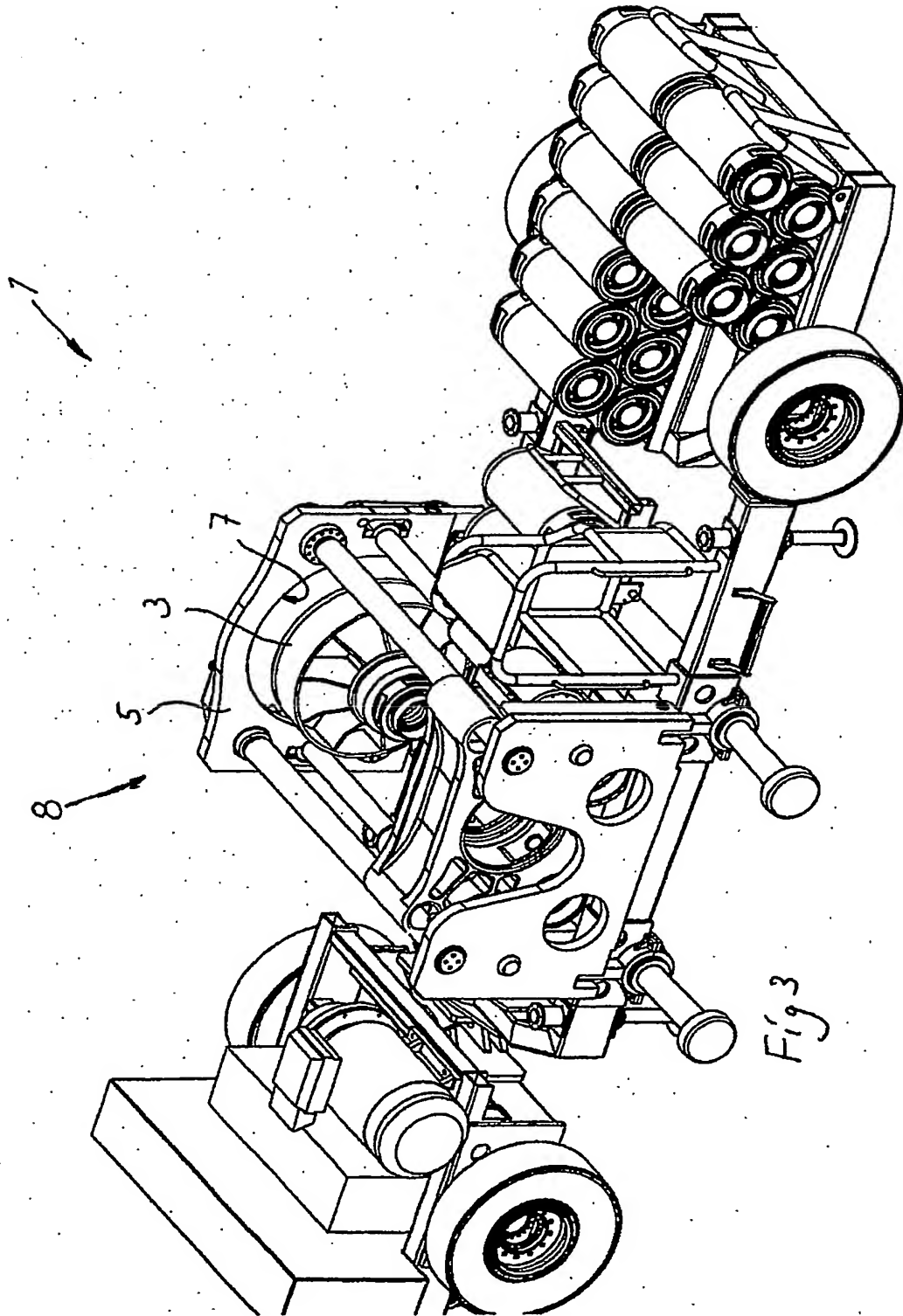
Abstract:

A holding wrench (6) for holding drill string components (2') and including positioning means (10) for moving at least two gripping means (9) into engagement with wrenching surfaces (20) of the drill string components, wherein the gripping means are pivotal in a plane perpendicular to a central axis of the drill string between an active, gripping position and an inactive, retracted position. The wrench is distinguished by each gripping means (9) including locking means (14) for interlocking engagement with engagement means (15) on an adjacent gripping means (9) in the active position so as to obtain a closed rigid wrench structure.

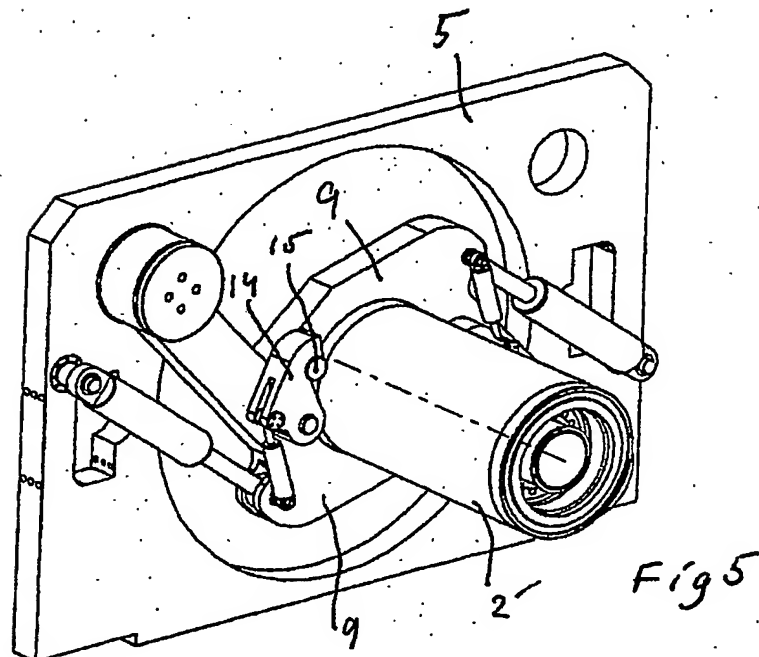
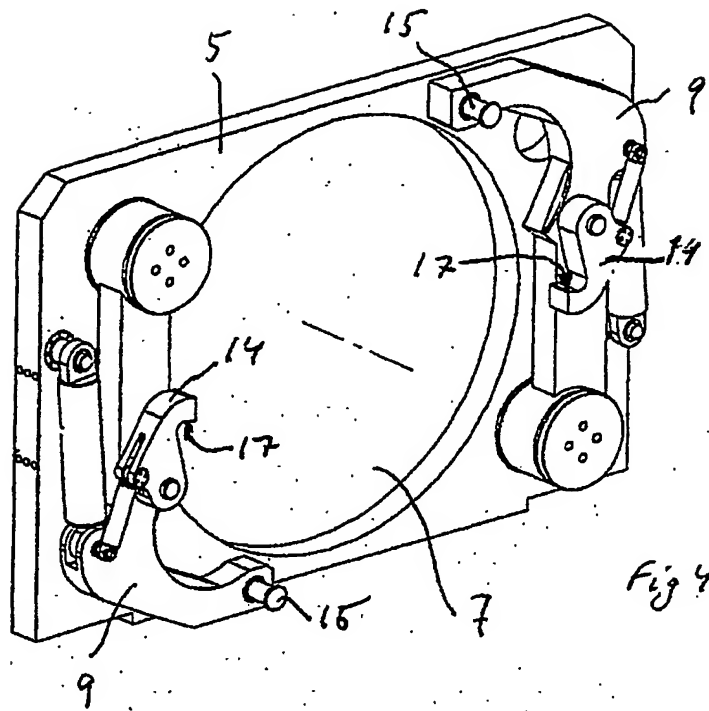
Figs 4 and 5.







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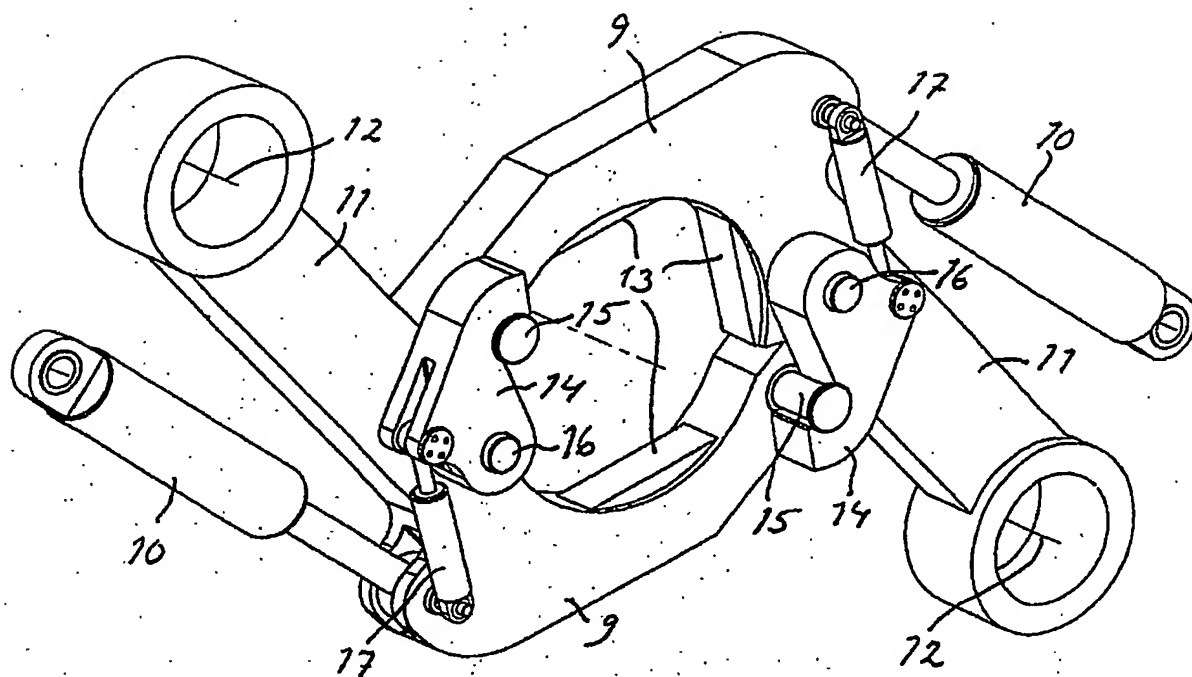


Fig 6

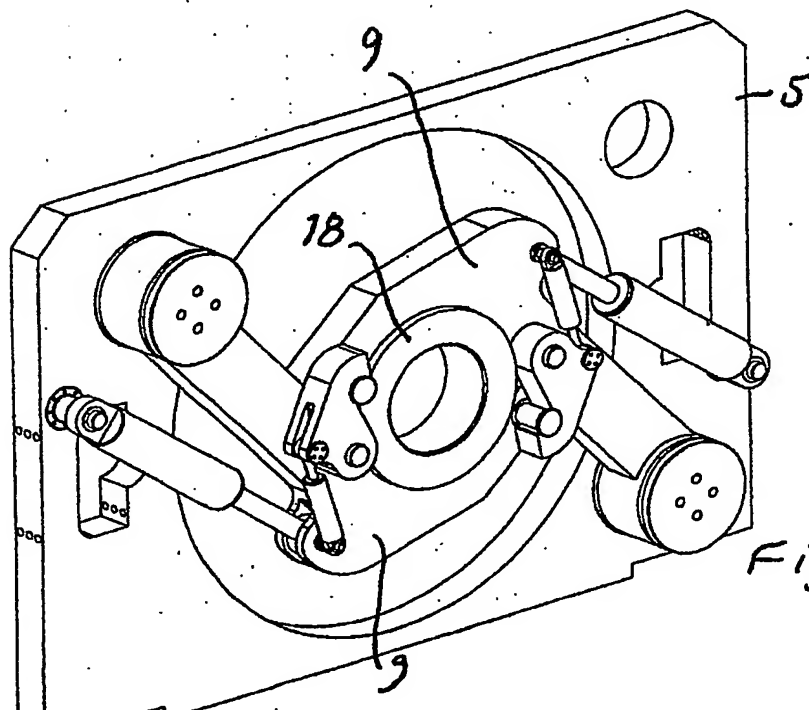


Fig 7

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